

ClaimsWE CLAIM:

1. A system for providing perspective corrected views of a distorted wide angle image at a location removed from the site of the creation of the distorted wide angle image without transmitting control signals to the site of the creation of the distorted image, the system comprising:

a camera-imaging system at a first site for receiving optical images and for producing output signals corresponding to the optical images;

a wide angle lens at the first site associated with the camera imaging system for producing the optical images throughout the field of view of the lens for optical conveyance to the camera imaging system, the optical images being distorted by the wide angle lens;

a transmitter at the first site to receive the output signals of the camera imaging system to transmit the output signals from the first site to at least one second site;

a receiver at the second site to receive signals transmitted by the transmitter;

image capture circuitry at the second site for receiving and digitizing signals from the receiver corresponding to output signals of the camera imaging system;

input image memory circuitry at the second site for receiving digital signals from the image capture circuitry;

5 image transform processor at the second site for processing the digitized signals in the input image memory circuitry according to selected viewing angles and degree of magnification, and for producing output transform calculations signals according to a  
10 combination of the digitized signals, the selected viewing angles and degree of magnification;

output image memory circuitry at the second site for receiving the output signals  
15 from the image transform processor;

input means at the second site for selecting the viewing angles and degree of magnification;

20 microprocessor means at the second site for receiving the selected viewing angles and degree of magnification from the input means and for converting the selected viewing angles and degree of magnification for input to the image transform processor to control the  
25 processing of the transform processor; and

output means at the second site connected to the output image memory circuitry to display the perspective corrected view according to the selected viewing angles and degree of  
30 magnification.

2. The system of Claim 1 wherein the transmitter includes signal compression circuitry and the receiver includes signal decompression circuitry whereby transmission of signals corresponding to the image are transmitted over telephone lines from the first site to the second site.

3. The system of Claim 1 wherein the transmitter includes wireless transmission circuitry and the receiver includes wireless receiving circuitry whereby transmission of signals corresponding to the image are transmitted via wireless techniques from the first site to the second site.

4. The system of Claim 1 wherein the input means comprises a plurality of control units for selecting the viewing angles and degree of magnification at each control unit.

5. The system of Claim 4 wherein at least one of the control units is a computer control for selecting the viewing angles and degree of magnification.

6. The system of Claim 1 further comprising surveillance mounting means for the wide angle lens and the camera imaging system in the first site whereby the camera imaging system provides output signals corresponding to

a distorted image of an area in the first site under surveillance for activity in the area.

5           7. The system of Claim 1 further comprising teleconference mounting means for the wide angle lens and the camera imaging system in the first site whereby the camera imaging system provides output signals corresponding to a distorted image of a display in the first site for teleconferencing of  
10 information contained in the display to the second site.

15           8. The system of Claim 1 wherein the output means includes recording means for recording the perspective corrected view according to the selected viewing angles and degree of magnification.

20           9. The system of Claim 1 wherein the input means includes means for selecting angles of tilt, pan and rotation, and for selecting a portion of the distorted wide angle image for processing a perspective correct view.

25           10. A system for providing perspective corrected views of a selected portion of a distorted wide angle image at a location removed from the site of the creation of the distorted wide angle image without transmitting

control signals to the site of the creation of the distorted image, the system comprising:

5 a camera-imaging system at a first site for receiving optical images and for producing output signals corresponding to the optical images;

10 a wide angle lens at the first site associated with the camera imaging system for producing the optical images throughout the field of view of the lens for optical conveyance to the camera imaging system, the optical images being distorted by the wide angle lens;

15 a transmitter at the first site to receive the output signals of the camera imaging system to transmit the output signals from the first site to at least one second site;

a receiver at the second site to receive signals transmitted by the transmitter;

20 image capture circuitry at the second site for receiving and digitizing signals from the receiver corresponding to output signals of the camera imaging system;

25 input image memory circuitry at the second site for receiving digital signals from the image capture circuitry;

30 image transform processor at the second site for processing the digitized signals in the input image memory circuitry according to selected viewing angles and degree of magnification, and for producing output

transform calculations signals according to a combination of the digitized signals, the selected viewing angles and degree of magnification;

5           output image memory circuitry at the second site for receiving the output signals from the image transform processor;

10           input means at the second site for selecting a portion of the distorted wide angle image, and selecting the viewing angles and degree of magnification;

15           microprocessor means at the second site for receiving the selected portion and selected viewing angles and degree of magnification from the input means and for converting the selected portion and selected viewing angles and degree of magnification for input to the image transform processor to control the processing of the transform processor; and

20           output means at the second site connected to the output image memory circuitry to display and record the perspective corrected view according to the selected portion of the image and the selected viewing angles and degree of magnification.

25           11. The system of Claim 1 wherein the transmitter includes signal compression circuitry and the receiver includes signal decompression circuitry whereby transmission of  
30           signals corresponding to the image are

transmitted over telephone lines from the first site to the second site.

5 12. The system of Claim 10 wherein the input means comprises a plurality of control units for selecting the portion of the image and selecting the viewing angles and degree of magnification at each control unit.

10 13. The system of Claim 12 wherein at least one of the control units is a computer control for selecting the portion of the image and selecting the viewing angles and degree of magnification.

15 14. The system of Claim 10 wherein the image transform processor is programmed to implement the following equations:

$$x = \frac{R[uA - vB + mR\sin\beta\sin\theta]}{\sqrt{u^2 + v^2 + m^2R^2}}$$

$$y = \frac{R[uC - vD - mR\sin\beta\cos\theta]}{\sqrt{u^2 + v^2 + m^2R^2}}$$

where:

$$A = (\cos\theta\cos\theta - \sin\theta\sin\theta\cos\beta)$$

$$B = (\sin\theta\cos\theta + \cos\theta\sin\theta\cos\beta)$$

$$C = (\cos\theta\sin\theta + \sin\theta\cos\theta\cos\beta)$$

$$D = (\sin\theta\sin\delta - \cos\theta\cos\delta\cos\beta)$$

and where:

R = radius of the image circle

$\beta$  = zenith angle

5  $\delta$  = Azimuth angle in image plane

$\theta$  = Object plane rotation angle

m = Magnification

u,v = object plane coordinates

x,y = image plane coordinates

15. A system for providing perspective corrected views of a selected portion of a distorted wide angle image at a location removed from the site of the creation of the distorted wide angle image without transmitting control signals to the site of the creation of the distorted image, the system comprising:

a camera-imaging system at a first site for receiving optical images and for producing output signals corresponding to the optical images;

a wide angle lens at the first site associated with the camera imaging system for producing the optical images throughout the field of view of the lens for optical conveyance to the camera imaging system, the optical images being distorted by the wide angle lens;

a transmitter at the first site to receive the output signals of the camera imaging system



to transmit the output signals from the first site to at least one second site;

a receiver at the second site to receive signals transmitted by the transmitter;

image capture circuitry at the second site for receiving and digitizing signals from the receiver corresponding to output signals of the camera imaging system;

input image memory circuitry at the second site for receiving digital signals from the image capture circuitry;

image transform processor at the second site for processing the digitized signals in the input image memory circuitry according to selected viewing angles and degree of magnification, and for producing output transform calculation signals according to a combination of the digitized signals, the selected viewing angles and degree of magnification, the transformation being according to the equations

$$x = \frac{R[uA - vB + mR\sin\theta\sin\phi]}{\sqrt{u^2 + v^2 + m^2R^2}}$$

$$y = \frac{R[uC - vD - mR\sin\theta\cos\phi]}{\sqrt{u^2 + v^2 + m^2R^2}}$$

where:

$$A = (\cos\theta\cos\phi - \sin\theta\sin\phi\cos\beta)$$

$$B = (\sin\theta\cos\delta + \cos\theta\sin\delta\cos\beta)$$

$$C = (\cos\theta\sin\delta + \sin\theta\cos\delta\cos\beta)$$

$$D = (\sin\theta\sin\delta - \cos\theta\cos\delta\cos\beta)$$

and where:

R = radius of the image circle

$\beta$  = zenith angle

$\delta$  = Azimuth angle in image plane

$\theta$  = Object plane rotation angle

m = Magnification

u,v = object plane coordinates

x,y = image plane coordinates

output image memory circuitry at the second site for receiving the output signals from the image transform processor;

input means at the second site for selecting a portion of the distorted wide angle image, and selecting the viewing angles and degree of magnification;

microprocessor means at the second site for receiving the selected portion and selected viewing angles and degree of magnification from the input means and for converting the selected portion and selected viewing angles and degree of magnification for input to the image transform processor to control the processing of the transform processor; and

output means at the second site connected to the output image memory circuitry to display and record the perspective corrected view according to the selected portion of the image

and the selected viewing angles and degree of magnification.

16. The system of Claim 15 further comprising surveillance mounting means for the wide angle lens and the camera imaging system in the first site whereby the camera imaging system provides output signals corresponding to a distorted image of an area in the first site under surveillance for activity in the area.

17. The system of Claim 15 further comprising teleconference mounting means for the wide angle lens and the camera imaging system in the first site whereby the camera imaging system provides output signals corresponding to a distorted image of a display in the first site for teleconferencing of information contained in the display to the second site.